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SUBSTITUTE SPECIFICATION
PAGES R12 AND R36
FOR
U.S. PATENT APPLICATION 09/569,109,

ATTORNEY DOCKET NO. M-5628 US

Oct 15, 2003

for example, indicates a set of four 1-D PAM-5 symbols where the first symbol is from type X, the second symbol is from type X, the third symbol is from type Y, and the fourth symbol is from type X. Therefore, conductor 103-1 (Figure 1) carriers a symbol of type X, conductor 103-2 carries a symbol of type X, conductor 103-3 carries a symbol of type Y and conductor 103-4 carries a symbol of type X.

Table 1 -- Mapping of 4-D symbols into sets D0 through D7

Subset	X Primary Code	Y Primary Code	#'of Symbols
D0	XXXX	YYYY	97
D1	XXXY	YYYX	78
D2	XXYY	YYXX	72
D3	XXYX	YYXY	78
D4	XYYX	YXXY	72
D5	XYYY	YXXX	78
D6	XYXY	YXYX	72
D7	XYXX	YXYY	78

[0056] The parity bit and bits 6 and 7 are input to set select 210 (Figure 2). Set select 210 determines a particular subset selection p, indicating that subset D_p of subsets D_0 through D_7 has been selected. In one embodiment, subset selection p is determined according to the formula

$$p = 4*BIT6 + 2*BIT7 + 1*Parity, \quad (1)$$

where BIT6 is bit 6, BIT7 is bit 7, and Parity is the parity bit.

[0057] A point within subset p is chosen by the six least significant bits of the input, bits 0 through 5. Bits 0 through 5 are input to a 4-D PAM-5 mapper 211 along with the output χ of set select 210. 4-D PAM-5 mapper 211 determines the 4-D PAM-5 symbol within set D_p which represents the eight input bits, bits 0 through 7, and the

performed every TB/2 sample times and traceback circuit 1106 outputs TB/2 data symbols. With little loss of generality, TB can be an even integer such as 6, 8 or 16. A greater traceback depth will result in less error in determining the final sequence of symbols. Greater traceback depths, however, incur an implementation cost of requiring more memory in traceback circuit 1103.

[0131] During the traceback procedure, starting state determiner 1105 picks the starting state, which can be based on the state metrics $p_{k,w}(S)$. Traceback circuit 1103 follows the sequence back through the comparison results stored in memory in traceback circuit 1103. The earliest TB/2 symbols, which result in the earliest states, are written into last-in-first-out buffer 1104. The new comparison results are stored in the memory locations previously occupied by the outputted results.

[0132] Traceback circuit 1103 determines the optimum sequence of symbols based on the state metrics $p_{k,w}(S)$ stored in starting state determiner 1105. Starting state determiner 1105 initializes the traceback procedure by setting a starting sequence.

[0133] LIFO 1104 simply time-reverses the data coming out of traceback circuit 1103 because the traceback is performed from the current time to previous times.

Sequence Detection with Pre-Equalization

[0134] When the channel ISI length δ is large, or if the transmitted symbol alphabet size A is large, the above method of full sequence estimation becomes impractical at high symbol rates. Full sequence estimations require the implementation of A^{δ} states in the detector. Accordingly, equalizer 1110 can provide pre-equalization by preprocessing the input samples $y_{k,w}$ in order to reduce the number of ISI symbols to be processed by sequence detector 1100.